

# **MARKSCHEME**

**November 2005**

**BIOLOGY**

**Higher Level**

**Paper 3**

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## General Marking Instructions

### Subject Details:      **Biology HL Paper 3 Markscheme**

#### Mark Allocation

Candidates are required to answer **ALL** questions in each of **TWO** Options (total *[20 marks]*).  
Maximum total = *[40 marks]*.

#### General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- ◆ Each marking point has a separate line and the end is signified by means of a semicolon (;).
- ◆ An alternative answer or wording is indicated in the markscheme by a “/”; either wording can be accepted.
- ◆ Words in ( ... ) in the markscheme are not necessary to gain the mark.
- ◆ The order of points does not have to be as written (unless stated otherwise).
- ◆ If the candidate’s answer has the same “meaning” or can be clearly interpreted as being the same as that in the markscheme then award the mark.
- ◆ Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have not achieved or what they have got wrong.
- ◆ Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts.
- ◆ Units should always be given where appropriate. Omission of units should only be penalized once.
- ◆ Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

**Option D — Evolution**

- D1.** (a) (Ye5)AH148 [1]
- (b) 324 base pairs (507–183) [1]
- (c) (Ye5)AH110;  
the insert is found only in humans/ not in the other species; [2]
- (d) bonobos are more closely related to chimpanzees (than orang-utans);  
bonobos and chimpanzees both contain Ye5AH31/B and Ye5AH140/C / have more  
fragments in common; [2]
- D2.** (a) (i) lightning / electrical discharge [1]
- (ii) *Award [1] for any two of the following.*  
N<sub>2</sub> / CO / water / ammonia / methane / hydrogen [1]
- (iii) organic acids/amino acids [1]
- (b) (RNA) was the first replicating material/genetic material and the first catalyst/enzyme  
(with clay minerals) [1]
- D3.** (a) splitting (of existing) species;  
involves isolation of population;  
can be due to migration;  
this will isolate the gene pool;  
the isolated population will diverge genetically / have different mutations;  
will be unable to interbreed with the rest of the species;  
*e.g.* Galapagos finches / other example;  
if two populations live in same area they can become isolated / ecological isolation;  
due to habitat isolation;  
due to behavioural isolation; [7 max]
- (b) Lamarck proposed inheritance of acquired characteristics;  
characteristics acquired during lifetime through use / characteristics lost through disuse;  
passed on to offspring;  
*e.g.* giraffe neck / blacksmith's arm;  
not generally accepted as valid; [3 max]

**Option E — Neurobiology and Behaviour**

- E1.** (a) light then dark (with CC) for *A. barbouri* [1]
- (b) the larvae are the same colour as the background / on a dark background the initial colour of larvae is dark/darker and on light background the initial colour is light/lighter [1]
- (c) CC causes no change / minimal change / small drop in (both initial and final) colour change in *A. barbouri* (compared to no CC) / overall range of colour change less than no CC;  
*A. texanum* initial colour is darker than *A. barbouri* / *A. barbouri* final colour lighter with CC than *A. texanum*;  
 CC causes larger (range) colour change in *A. texanum* (compared to no CC) / CC makes *A. texanum* become lighter in colour compared with than no CC / initial colour is darker with CC than no CC; [2 max]
- (d) hide / seek refuge / swim / move away / stay still;  
 produce defensive chemicals; [1 max]
- (e) presence of sunfish is a new selection factor;  
 selects for larvae that change colour to match background;  
 those that survive pass on the genes to their offspring; [2 max]
- E2.** (a) A: bipolar neuron;  
 B: cone; [1]  
*Both needed for [1].*
- (b) bipolar cells combine impulses;  
 bipolar cells pass impulses to optic nerve / ganglion cells;  
 left and right optic nerve meet at optic chiasma;  
 information carried to the thalamus;  
 sent to visual cortex / occipital lobe for processing;  
 left optic tract carries information / left visual cortex processes information from right half of visual field (of both eyes)/ *vice versa*; [3 max]

- E3.** (a) autonomic nervous system part of peripheral nervous system;  
two components: sympathetic and parasympathetic;  
sympathetic and parasympathetic with antagonistic responses;  
examples of both sympathetic and parasympathetic;  
(most) autonomic reflexes under unconscious control;  
can come under conscious control / learned behaviour;  
formation of new pathways (in brain);  
young children learn conscious control of sphincter of bladder/anus;  
can control heart rate/blood pressure with yoga/meditation;  
*Award [3 max] if no mention of relationship to conscious part of brain.*

**[5 max]**

- (b) pain receptors located in skin / organs;  
signal sent to brain / control centre in CNS for conscious pain sensation;  
natural pain killers are endorphins / enkephalins;  
enkephalins block calcium channels of pre-synaptic neurons;  
block transmission of pain signals;  
endorphins released by pituitary gland;  
bind to receptors of membranes of neurons that send signal;  
may block release of neurotransmitters/no signal sent;

**[4 max]**

**Option F — Applied Plant and Animal Science**

- F1.** (a)  $100(\pm 10) \text{ g yr}^{-1}$  (*units needed*) [1]
- (b)  $33(\pm 3)\%$  (*units needed*) [1]
- (c) poultry has more total fertilizer nutrients than cattle or pigs / cattle least;  
poultry has more P and N than cattle or pigs / cattle least;  
all manures have the similar amounts of K / poultry have slightly more than pigs  
which are more than cattle; [2 max]
- (d) some crops grow better / worse in alkaline conditions [1]
- (e) energy production / methane;  
feed for other animals;  
fuel;  
building; [1 max]
- F2.** (a) obtaining offspring by crossing unrelated individuals  
*Do not accept inter-specific breeding.* [1]
- (b) rice varieties with desirable traits were crossed;  
offspring were selected for further trials;  
a semi-dwarf variety was crossbred with a fast growing variety;  
this produced IR8;  
it can give yields greater than/twice the normal amount;  
*Award any other named example.* [3 max]
- F3.** (a) auxin promotes the rooting of cuttings for plant propagation;  
high levels of auxin can be used as a herbicide (to kill broad leaf plants);  
ethene can be used to induce fruit ripening;  
auxin/gibberellins can be used to produce seedless fruit; [3 max]
- (b) (photoperiod) detected by leaves;  
need dark period shorter than critical dark period;  
dark period can be artificially shortened with a flash of light (causing plant to flower);  
phytochrome controls flowering;  
phytochrome measures the length of the night/dark period;  
phytochrome exists in two forms;  
(Pr) absorbs red light/660 nm and (Pfr) absorbs far red light/730 nm;  
the two forms can be interconverted (between the two forms);  
during the day, most phytochrome exists in the Pfr form;  
Pfr converts to Pr during the night/dark;  
during the short nights, Pfr remains at the end of the night period;  
this stimulates flowering (in long day plants); [7 max]

**Option G — Ecology and Conservation**

- G1.** (a) (i) 24(±2) mm [1]
- (ii) Sheyma Island as there are larger sea urchins found on the island [1]
- (b) sea urchin biomass is greater on Sheyma Island than Amchitka Island;  
sea urchin density is similar on both islands / slightly larger on Sheyma Island;  
Amchitka Island has no sea urchins bigger than 40 mm diameter while Sheyma Island does / diameter range smaller on Amchitka Island than Sheyma Island; [2 max]
- (c) herbivore / primary consumer [1]
- (d) sea otters feed on urchins;  
sea otters keep the sea urchin density/biomass at lower levels;  
Amchitka Island shows high numbers of small (diameter) sea urchins and no large ones due to presence of sea otters / *vice versa* on Sheyma Island; [2 max]
- G2.** lichens/bacteria destroy rock through acidic secretions;  
lichens/mosses trap soil;  
lichens and mosses decompose / add organic matter to soil;  
makes community more liveable for new plants/animals;  
can reach a stable climax community;  
plant roots help prevent erosion; [3 max]
- G3.** (a) humans add ammonia/nitrates with the addition of fertilizer to the soil;  
farmers plant legumes which are nitrogen fixers to add nitrogen to the soil;  
plowing increases aeration which increases nitrification;  
excess nitrates are leached from soil;  
can enter rivers and lakes;  
eutrophication / can cause algal blooms / excessive growth of algae causes some algae to die;  
bacteria decompose dead algae / increased biological oxygen demand / consumes oxygen in river/lake;  
kill fish;  
humans add nitrogen oxides to the atmosphere from vehicles / industry / combustion;  
human wastes / sewage / organic wastes go into water;  
decomposers increase the N-containing substances in the water; [7 max]
- (b) nitric oxides and sulfur dioxides form acids in rain water;  
acid rain lowers pH;  
can kill fish;  
acid rain leaches aluminium (Al) from soil;  
aluminium is toxic to fish; [3 max]



**Option H — Further Human Physiology**

**H1.** (a)  $\frac{(4.70 - 4.40 \times 100)}{4.40} = 6.82\%$  [1]

(b) for comparison with data collected (after two and five weeks) with and without aspirin treatment [1]

(c) blood levels of creatine, urea and uric acid increased (over control group);  
urine creatine clearance decreased (while control group increased); [2]

(d) the effect is likely to be permanent;  
because uric acid concentration remains high after five weeks;  
and creatine clearance rate is still (very) low after five weeks;  
not enough data / long enough time to predict;

**or:**

the effect is unlikely to be permanent;  
as blood creatine concentration / most substances at the end of week five is lower than/close to baseline level;  
and blood urea concentration is reduced from the peak at two weeks / dropping;  
not enough data/ long enough time to predict;

[3 max]

**H2.** CO<sub>2</sub> can be dissolved in the plasma;

(most) CO<sub>2</sub> is converted to hydrogen carbonate/bicarbonate ions (in plasma);

also in red blood cells by enzyme (carbonic anhydrase);

hydrogen carbonate/bicarbonate ions diffuse out into plasma;

some CO<sub>2</sub> binds to haemoglobin (to form carbaminohemoglobin);

[3 max]

**H3.** (a) *saliva:* [2 max]  
salivary amylase;  
mucus;

water/ lysozymes/ HCO<sub>3</sub><sup>-</sup> / minerals / immunoglobins / other correct answer;

*gastric juice:* [2 max]

hydrochloric acid;

pepsinogen / pepsin;

mucus;

water / hormones / other correct answer;

[4 max]

(b) digested foods absorbed through the villi;  
pass through plasma membrane of epithelium cells;  
microvilli increase surface area for absorption;  
lipids/fatty acids and glycerol enter the cells by (simple) diffusion;  
fructose enters by facilitated diffusion;  
glucose enters by active transport;  
sugars transported via the bloodstream;  
lipids enter the lacteal;  
lipids travel via the lymph system;  
pinocytosis-forming vesicles, absorption from vesicles;

[6 max]